UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

THE DIRECTOR

JUN 27 2006

MEMORANDUM FOR: Rodney F. Weiher, Ph.D.
NEPA Coordinator
Office of Program Planning and Integration

FROM: William T. Hogarth, Ph.D.

SUBJECT: Finding of No Significant Impact on the Issuance of an Incidental Harassment Authorization for the 2006 Rim of the Pacific Antisubmarine Warfare Exercises--DECISION MEMORANDUM

Based on the subject environmental assessment and attached Finding of No Significant Impact, I have determined that no significant environmental impacts will result from the subject action. I request your concurrence in this determination by signing below. Please return this memorandum for our files.

concur. Rodney Weiher 6/27/06
Date

2. do not concur. _____
Date

Attachment

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

Action: Finding of No Significant Impact (FONSI)

Summary The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) received an application from the U.S. Navy (Navy) pursuant to its responsibility under the Marine Mammal Protection Act (MMPA,) to take several species of marine mammals incidental to the Navy's Rim of the Pacific (RIMPAC) Anti-submarine Warfare (ASW) exercises. The Navy, with NMFS as a cooperating agency, has prepared a Supplement to the 2002 RIMPAC Programmatic Environmental Assessment (EA) addressing environmental impacts resulting from the exercise and by extension, the issuance of an MMPA Incidental Harassment Authorization for this activity. The EA contains a description of the proposed action and alternatives, the affected environment, the potential impacts to marine mammals, and appropriate mitigation measures.

Determination NOAA's Administrative Order (NAO) 216-6 (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. Each criterion is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action, the issuance of an Incidental Harassment Authorization for RIMPAC 2006, has been analyzed based on the NOAA's criteria, Council on Environmental Quality (CEQ) regulations, and the analysis in the EA relevant to the IHA. Considering the factors listed above and the mitigation requirements in the IHA and considering the comments received on the proposed IHA and EA, NOAA has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, the preparation of an Environmental Impact Statement is not required.

Background Sections 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stocks(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS received an application from the Navy for the taking, by harassment, of several species of marine mammals incidental to conducting RIMPAC ASW training events in the summer of 2006. The RIMPAC ASW exercises are considered a military readiness activity.

Purpose and Need RIMPAC has been conducted at various locations throughout the State of Hawaii and surrounding ocean areas biennially since 1968. The purpose of RIMPAC is to implement a selected set of exercises that are combined into a multinational, sea control/power projection Fleet training exercise in a multi-threat environment. RIMPAC exercises enhance the abilities of a multinational Fleet force to communicate and operate in simulated hostile scenarios.

The purpose of the IHA is to authorize the take of marine mammals, pursuant to the MMPA, incidental to the RIMPAC ASQ activities.

Proposed Action The proposed action under review and subject to this finding is the determination by the NMFS Permits, Conservation and Education Division to issue an IHA to the U.S. Navy pursuant to the MMPA of 1972, as amended (MMPA; 16 U.S.C. 1361 *et seq.*) to allow non-lethal harassment of marine mammals associated with the proposed RIMPAC exercises. The analysis of the IHA impact is based on the activities associated with RIMPAC 2006.

RIMPAC 2006 ASW activities are scheduled to take place from June 26, 2006, to about July 28, 2006, with ASW training events planned on 21 days. As a combined force during the exercises, submarines, surface ships, and aircraft will conduct ASW against opposition submarine targets. Submarine targets include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. ASW training events are complex and highly variable. For RIMPAC, the primary event involves a Surface Action Group (SAG), consisting of one to five surface ships equipped with sonar, with one or more helicopters, and a P-3 aircraft searching for one or more submarines. There will be approximately four SAGs for RIMPAC 2006. There will be approximately 44 ASW operations during RIMPAC with an average event length of approximately 12 hours. Training event durations ranged from 2 hours to 24 hours.

The tactical military sonars to be deployed in RIMPAC are designed to detect submarines in tactical operational scenarios. This task requires the use of the sonar mid-frequency (MF) range (1 kilohertz [kHz] to 10 kHz) predominantly. A variety of surface ships participate in RIMPAC, including guided missile cruisers, destroyers, guided missile destroyers, and frigates. Some ships (e.g., aircraft carriers) do not have any onboard active sonar systems, other than fathometers. Others, like guided missile cruisers, are equipped with active as well as passive sonars for submarine detection and tracking.

Supporting NEPA Analyses In 2002, a Programmatic EA (PEA) was prepared in support of the RIMPAC exercises. The PEA identified the Proposed Action as the set of exercises and locations that would be used for RIMPAC activities for the foreseeable future. It identified the maximum usage of ongoing training assets and exercises that could be conducted within a given RIMPAC event and evaluated the impacts on the environment within those bounds. The FONSI for the RIMPAC PEA, signed June 11, 2002, concluded that as long as future RIMPAC exercises did not exceed the evaluated set of events, the Proposed Action could be implemented without supplemental NEPA documentation. The scope of each future RIMPAC exercise has been evaluated for consistency with the 2002 RIMPAC PEA and its FONSI.

In June 2004 a supplement (SPEA) was prepared to analyze a set of proposed RIMPAC training events that were not addressed in the RIMPAC PEA. The determination of that supplement was that the additional activities would not have a significant effect on the environment.

The Navy developed a Supplemental Environmental Assessment (SEA) in 2006 to evaluate new training event locations and to compare all proposed RIMPAC 2006 events to the analysis of training events in the 2002 RIMPAC PEA and 2004 SPEA to ensure all 2006 proposed events

were addressed, if they were not previously evaluated. The 2006 SEA determined that the additional activities would not have a significant effect on the environment.

Additionally, the Navy has prepared a Draft Environmental Impact Statement for its Undersea Warfare Training Range, which contains detailed supporting information for some of the issues discussed in this FONSI.

Endangered Species Act Analyses Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1539(a)(2)) requires each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency "may affect" a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. For the actions described in the Biological Opinion, the action agency is the United States Navy, Pacific Fleet, and NMFS' Office of Protected Resources - Permits, Conservation and Education Division. The consulting agency is NMFS' Office of Protected Resources - Endangered Species Division.

After reviewing the current status of the endangered Hawaiian monk seal, endangered blue whale, fin whale, right whale, sei whale, and sperm whale, threatened and endangered sea turtles, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, it is NMFS' biological opinion that the Navy's proposed RIMPAC 2006 exercises in waters off the State of Hawaii and NMFS' proposed issuance of an IHA for the "take," in the form of harassment, of marine mammals during the anti-submarine warfare portions of those exercises may adversely affect, but is not likely to jeopardize the continued existence of these threatened and endangered species under NMFS jurisdiction.

Environmental Impacts of the issuance of the IHA

Refer to the IHA Federal Register notice for detailed analysis of the potential affects of tactical mid-range sonar on the marine mammals in the OpArea. In general, marine mammals may experience a) physiological effects, including damage to the auditory system, and stress responses, including physiological changes that have consequences for the health and ecological fitness of marine mammals; and b) behavioral effects, including activities that disrupt natural behavioral patterns.

Impact Analysis Parameters – The IHA Federal Register Notice and the Biological Opinion describe in greater detail the parameters used for the impacts analyses. A summary of the parameters and impact analyses follows.

The OpArea is approximately 210,000 square nautical miles (nm), however, nearly all RIMPAC ASW training would occur in the six areas delineated in Figure 2-1 in the Navy's application (approximate 46,000 square nm). For purposes of the IHA and therefore the NEPA impact analysis, all likely RIMPAC ASW events were modeled as occurring in these six areas.

There are 27 marine mammal species with possible or confirmed occurrence in the Navy's OpArea: 25 cetacean species (whales, dolphins, and porpoises) and 2 pinnipeds (seals). In addition, five species of sea turtles are known to occur in the OpArea.
The most abundant marine mammals are rough-toothed dolphins, dwarf sperm whales, and Fraser's dolphins. The most abundant large whales are sperm whales. There are three seasonally migrating baleen whale species that winter in Hawaiian waters: minke, fin, and humpback whales. Humpback whales utilize Hawaiian waters as a major breeding ground during winter and spring (November through April), but should not be present during the RIMPAC exercise, which takes place in July. Because definitive information on the other two migrating species is lacking, their possible presence during the July timeframe is assumed, although it is considered unlikely. Seven marine mammal species listed as federally endangered under the ESA occur in the area: the humpback whale, North Pacific right whale, sei whale, fin whale, blue whale, sperm whale, and Hawaiian monk seal.

For the purposes of this analysis, each event in which a SAG participates is counted as an ASW operation. One or more ASW events may occur simultaneously within the OpArea. A total of 532 training hours were modeled for RIMPAC acoustic exposures. This total includes all potential ASW training that is expected to occur during RIMPAC.

For purposes of the analysis, all surface ship sonars were modeled as having the nominal source level of 235 decibels (dB) re 1mPa^2-s (SEL). Since the SQS-53 hull mounted sonar is the U.S. Navy's most powerful surface ship hull mounted sonar, modeling this source is a conservative assumption tending towards an overestimation of potential effects. Sonar ping transmission durations were modeled as lasting 1 second per ping and omnidirectional, which is a conservative assumption that overestimates potential exposures, since actual ping durations will be less than 1 second. However, the Navy has informed NMFS, in a classified briefing, circumstances in which they will operate at a higher source level. NMFS analyzed the conditions associated with these circumstances as part of our FONSI determination.

Submarine active sonars, aircraft sonar systems, Acoustic Device Countermeasures, and range pingers were not modeled for RIMPAC 2006. The EA and IHA describe in detail the reasons for their exclusion from the analysis.
As noted in the Biological Opinion, the analysis assumes that mid-frequency sonar poses no risk to species or habitat that are not exposed to sound pressure levels from the mid-frequency sound sources. Our analyses also assumed that the potential consequences of exposure to mid-frequency sonar on individual animals would be a function of the intensity, duration, and frequency of the animals exposure to the mid-frequency transmissions.

Focus of Impacts Analysis In order to estimate acoustic exposures and therefore impacts to marine mammals from the RIMPAC ASW operations, acoustic sources to be used were examined with regard to their operational characteristics. Systems with acoustic source levels below 205 dB re 1 mPa were not included in the analysis given that at this source level (205 dB re 1 mPa) or below, a 1-second ping would attenuate below the behavioral disturbance threshold of 173 dB at a distance of about 100 meters (see later discussion of 173 dB in IHA Federal Register Notice and later in this document). In addition, systems with an operating frequency greater than 100 kHz were not analyzed in the detailed modeling as these signals attenuate

rapidly, resulting in very short propagation distances. Based on the information above, only hull mounted mid-frequency active tactical sonar was determined to have the potential to affect marine mammals protected under the MMPA and ESA during RIMPAC ASW training events.

Significance Determination

Based on CEQ NEPA regulations, the primary factor to consider in determining the level of impacts is the intensity of impacts. Intensity refers to the effects of the action on the characteristics of the geographic area, the degree to which impacts are uncertain and the degree of controversy regarding the effects. As further guidance in making this determination the CEQ regulations require agencies to consider 10 factors to evaluate intensity:

Impacts that may be both beneficial and adverse

Based on information from the EA and IHA Federal Register Notice and supporting documents, we do not anticipate any beneficial environmental impacts from the action of issuing the IHA. However, we anticipate benefits to society from the RIMPAC exercise because of the value of training to improve military readiness.

The degree to which the proposed action affects public health or safety

The Navy uses Standard Operating Procedures (SOPs) which include the implementation of clearance zones around potentially dangerous areas to ensure the safety of both Navy personnel and civilians that may be in the vicinity of Navy activities. Public Safety during RIMPAC is addressed in the Navy's 2002 RIMPAC PEA, to which the 2006 EA is a supplement. Based on these SOPs and the analysis in the EAs, NMFS does not believe that the issuance of the IHA will have a substantial adverse impact on public health or safety.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

The Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) and a small, southeasterly portion of the newly designated Northwestern Hawaiian Islands Marine National Monument (NWHIMNM) fall within the Navy's Hawaiian Islands OpArea. At times during RIMPAC exercises, the Navy will operate mid-frequency active tactical sonars within the HIHWNMS and not within the NWHIMNM. Though the HIHWNMS is an important breeding area for Humpback whales during the winter and spring, the exercises will be conducted in July when no humpback whales are expected to be present. Portions of the NWHIMNM may be indirectly ensonified by Navy mid-frequency active sonar use well outside the NWHIMNM. NMFS does not believe that the levels received in the NWHIMNM would have a significant adverse impact on NWHIMNM resources. Given the seasonal timing of the event, the limited time tactical sonar will be active, and the mitigation measures in place, NMFS does not believe this activity will have a significant adverse impact on these resources.

The degree to which the effects on the quality of the human environment are likely to be highly controversial.

A project is highly controversial if there is a substantial dispute about the size, nature, or effect of the major federal action rather than the mere existence of opposition to a use. Within the 30-day comment period, NMFS received approximately 120 comments, 8 of which were from environmental non-governmental organizations and addressed multiple substantive issues and generally opposed the proposed action. The IHA considers these comments, and makes a reasoned explanation for the position adopted. The controversy surrounding this activity centers around the scientific uncertainty associated with the lack of complete information on the subject of the impacts of anthropogenic sound generally, and mid-range tactical sonar specifically, on marine mammals. The question of scientific uncertainty is addressed in Appendix A.

The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The discussion of uncertainty and unknown risks is addressed in detail in Appendix A, Incomplete and Unavailable Information. The Navy has informed NMFS, in a classified briefing, circumstances in which they will operate at a higher source level than 235 dB. NMFS analyzed the conditions associated with these circumstances as part of our FONSI determination.

The use of mid-range tactical sonar is not unique, although the issuance of an IHA for mid-range tactical sonar is unique. However, by issuing the IHA the use of the mid-range tactical sonar is subject to greater conservation measures in the form of mitigation measures.

The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

NMFS analyzes each MMPA authorization application on a case-by-case basis and makes subsequent determinations based on many factors, including the nature and scope of the activity and effects, the status of the animals that will be exposed, the proposed mitigation and monitoring measures, and the best available science, so any one determination or decision does not necessarily have implications in future actions. The science of acoustics and marine mammals is constantly evolving therefore each application under the MMPA will have to be evaluated on its merit with respect to the circumstances relevant to that application and the body of existing science.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.

The marine mammals that occur in the action area are regularly exposed to several sources of natural and anthropogenic sounds. Anthropogenic noises that could affect ambient noise in the area include transportation, dredging, construction; oil, gas, and mineral exploration in offshore areas; geophysical (seismic) surveys; sonars; explosions; and ocean research activities. There is evidence that anthropogenic noise has increased the ambient level of sound in the ocean over the last 50 years in large part due to increased shipping. Commercial fishing vessels, cruise ships, transport boats, airplanes, helicopters, and recreational boats all contribute sound into the ocean. Many researchers have described behavioral responses of marine mammals to the sounds

produced by helicopters and fixed-wing aircraft, boats and ships, as well as dredging, construction, geological explorations, etc. Most observations have been limited to short-term behavioral responses, which included cessation of feeding, resting, or social interactions (NMFS Biological Opinion).

Private and commercial vessels engaged in marine mammal watching also have the potential to impact marine mammals. One concern is that animals may become more vulnerable to vessel strikes and another is that preferred habitats may be abandoned if disturbance levels are too high. NMFS has promulgated regulations to reduce impacts from whale watching and close encounters with certain species of marine mammals.

Marine mammals have been the subject of scientific field studies for decades. Over time, NMFS has issued dozens of permits for various non-lethal forms of "take" of marine mammals in the proposed area from a variety of activities, including aerial and vessel surveys, photo-identification, remote biopsy sampling, and attachment of scientific instruments.

The anthropogenic activities described above represent potential impacts to marine mammals in Hawaiian waters through effects on the behavioral, physiological, or social ecology of marine mammals.

The Navy's EA indicates that other military activities involving acoustic effects from mid-frequency active tactical sonar within the Hawaiian Islands are currently being evaluated in an additional NEPA document, the EIS/Overseas EIS for the Hawaiian Range Complex to include the PMRF.

Several commenters have expressed concern about the cumulative impact of marine sounds on the ocean environment and its organisms. Any man-made sound that is strong enough to be audible (detectable above natural background noise) will increase total background levels and could interfere with an animal's ability to detect sound signals. Concern about the cumulative impact of man-made sounds focuses on impacts from individual actions that are insignificant or minor when considered in isolation, but combine to produce effects that are greater than any individual action (either because the effects are synergistic - effects that occur when two or more phenomena interact - multiplicative, or additive).

The proposed RIMPAC exercises will add mid-frequency sound to ambient oceanic noise levels, which, in turn, could have cumulative impacts on the ocean environment. During transmissions, mid-frequency tactical sonar will add to regional noise levels. Unfortunately, there are no reliable methods for assessing these potential cumulative impacts. The U.S. Navy conducted computer simulations to assess the potential cumulative impacts of RIMPAC ASW tactical sonar. That assessment concluded that the "cumulative impacts" of mid-frequency tactical sonar would be "extremely small" because the proposed RIMPAC ASW exercises would occur for a relatively short period of time every other year, for relatively short periods of time in any given area; the system would not be stationary, and the information available suggests that the effects of any mid-frequency exposure would stop when transmissions stop.

Richardson *et al.* (1995) recommended several operational measures to minimize the effects of man-made sounds on marine mammals. These included minimizing source levels, minimizing duty cycles, and gradually increasing projected sound levels to allow animals to move away from the source before source levels peak. The IHA includes mitigation measures into the proposed RIMPAC ASW exercises, the implementation of which are expected to minimize the potential cumulative impacts of mid-frequency tactical sonar on marine mammals.

Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

The issuance of the IHA is unlikely to have any impacts on terrestrial resources because of the location of the activity. NMFS is aware of no significant scientific, cultural, or historical sites in the immediate area of RIMPAC and, therefore, does not believe that the proposed action is likely to adversely affect any.

Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

NMFS has determined that the RIMPAC ASW exercises will result in Level B harassment of several species of marine mammals. This harassment will consist primarily of temporary behavioral modifications, in the form of temporary displacement from feeding or sheltering areas, low-level physiological stress responses, and, to a lesser extent, temporary hearing threshold shift. The IHA does not authorize Level A Harassment, injury or death. Though NMFS cannot completely rule out the possibility that certain odontocetes could respond to mid-frequency tactical sonar in a manner that could result in a stranding, the probability of a stranding occurring as a result of the RIMPAC exercises is decreased through the incorporation of the mitigation measures required by the IHA. Because the IHA does not authorize injury or mortality, NMFS has developed a set of specific and conservative shutdown criteria as part in the event of a stranding or other evidence of injury during the RIMPAC exercises.

Pursuant to the MMPA, a negligible impact determination must be made to authorize the take. Negligible impact is defined as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." Because NMFS does not expect any mortality or injury to result from these activities, and because the Level B harassment will take place over a relatively short and finite period of time, NMFS believes the authorized takings, by harassment, can be reasonably expected to not adversely affect the species or stock through effects on annual rates of survival. NMFS acknowledges that Level B Harassment to large enough portions of a species or stock or over a long enough time could potentially adversely affect survival rates, however, due to the required mitigation and monitoring during this proposed activity (which reduce the numbers of animals exposed and the levels they are exposed to), as well as the duration and nature of the activities, NMFS does not believe RIMPAC will adversely affect survival.

Some portion of the animals exposed to SELs greater than 173 dB during the RIMPAC exercises will likely undergo a physiological stress response. Relationships between stress responses and inhibition of reproduction have been well-documented. However, NMFS believes the manner in which individual animals respond to different stressors varies across a continuum that is normally distributed with hyper-sensitive and hypo-sensitive animals being on the tails of the curve. Therefore, NMFS does not believe that much more than a small portion of animals exposed to sound levels above 173 dB would respond in a manner that physiologically inhibits reproduction. Additionally, suppression of reproduction would only be of a concern to species whose period of reproductive activity overlaps in time and space with RIMPAC. NMFS also believes that due to the enhanced nature of the monitoring required in this authorization, combined with the shutdown zones, the likelihood of seeing and avoiding mother/calf pairs or animals engaged in social reproductive behaviors is high. Consequently, NMFS believes it is unlikely the authorized takings will adversely affect the species or stocks through effects on annual rates of recruitment.

Both the Navy and the NMFS Division of Permits, Conservation, and Education have consulted with the NMFS Endangered Species Division pursuant to the Endangered Species Act (ESA). After reviewing the current status of the endangered Hawaiian monk seal, endangered blue whale, fin whale, right whale, sei whale, and sperm whale, threatened and endangered sea turtles, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, it is NMFS' biological opinion that the Navy's proposed RIMPAC 2006 exercises in waters off the State of Hawaii and NMFS' proposed issuance of an IHA for the "take," in the form of harassment, of marine mammals during the anti-submarine warfare portions of those exercises may adversely affect, but is not likely to jeopardize the continued existence of these threatened and endangered species under NMFS jurisdiction. The level of adverse effect is not anticipated to rise above those discussed above.

Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

NMFS has determined that this action will not violate any Federal, State, or local law, or requirements imposed for the protection of the environment.

Additional Criteria

In addition to the criteria for significance determination in the CEQ Regulations, NOAA requires consideration of additional criteria.

Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?

Marine mammal and essential fish habitat may be affected by the acoustic exposures resulting from ASW activities. Although there have been very few studies on the impact of mid-frequency tactical sonar on habitat NMFS does not anticipate the proposed activities would cause significant impacts to the ocean and coastal habitats and/or essential fish habitat because the

exposures do not constitute a long term physical alteration of the water column or bottom topography, the occurrences are of limited duration and are intermittent in time. Additionally, the mitigation measures required to protect marine mammals will also serve to protect ocean and coastal habitats from any significant effects.

Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

There have been few studies on the impact of sonar on fish. Based on the scientific literature NMFS believe that RIMPAC mid-frequency tactical sonar operations would have a minimal effect on any stocks of fish in the Hawaii area. There is not enough information to have scientifically supportable guidance on appropriate mitigation for fish. However, given the mitigation measures in place for protecting marine mammals, and the scientific literature on the effects of anthropogentic sound on fish, NMFS anticipates that these measures could also have a positive effect on protecting fish.

The effects of this action are temporary and acoustic in nature. In as much as the action may cause short-term behavioral disturbances to marine mammals, it may temporarily disrupt related predator-prey relationships. However, NMFS does not expect these short-term disruptions to have a substantial impact on biodiversity or ecosystem function within the affected area. Mitigation measures to protect marine mammals will have benefits for protection of ecosystem function.

Are significant social or economic impacts interrelated with natural or physical environmental effects?

NMFS is aware of no significant social or economic impacts interrelated with natural or physical environmental effects of this action. NMFS received approximately 200 comments on the issuance of the IHA; none of these comments raised concerns regarding social or economic impacts.

Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

NMFS is aware of no mechanisms within the proposed action that could result in the introduction or spread of a non-indigenous species.

Mitigation

Major Considerations in Establishing Mitigation Measures.

There are two areas of scientific uncertainty that have influenced the majority of the required mitigation measures to ensure the effects of this activity are insignificant. These two areas are associated with reducing the potential for injury, stranding, and mortality, especially with regard

to beaked whales, and reducing and minimizing sub-TTS behavioral effects. Additional areas of uncertainty and the associated mitigation measures are addressed in Appendices A and B.

1) Potential for mortality

Several mass stranding events of cetaceans that have occurred over the past two decades have been associated with activities that introduce sound into the marine environment. These events were a significant factor in our analysis and our development of mitigation measures to avoid these circumstances.

Several authors have noted similarities among the incidences of strandings coincident with sonar use: they occurred around islands or archipelagoes with deep water nearby, several appeared to have been associated with acoustic waveguides like surface ducting, steep canyons, constricted channels with limited egress, and the sound fields created by ships transmitting mid-frequency sonar. Cuvier's beaked whales have been the most common species involved in these stranding events. One incident in particular has provided significant information with respect to our approach to mitigation.

On March 15 and 15, 2000, a multi-species stranding of seventeen marine mammals was discovered in the Northeast and Northwest Providence Channels on Bahamian Islands. The strandings took place within 24 hours of U.S. Navy ships using active mid-range sonar as they passed through the Northeast and Northwest Providence Channels. A combination of specific physical oceanographic features, bathymetry, presence of beaked whales, and specific sound sources were present. Six of the whales and one dolphin (unassociated) died after stranding on beaches. While the precise causal mechanisms of the strandings are unknown, all evidence points to acoustic or impulse trauma. The sound source was active in a complex environment that included the presence of a surface duct, unusual underwater bathymetry, constricted channel with limited egress, intensive use of multiple, active sonar units over an extended period of time, and the presence of beaked whales that appear to be sensitive to the frequencies produced by these sonars. The conclusion of a report by NOAA and Navy is that the cause of this stranding event was the confluence of the Navy tactical mid-range frequency sonar and the contributory factors noted above acting together.

In addition to the mass stranding events, we examined stranding information from the Hawaiian Islands that has been collected since the late 1930s. Until recently, however, there has been no correlation between the number of recorded stranding events and activities like RIMPAC exercises. The number of strandings have increased over time, but the number of strandings in the main Hawaiian Islands recorded between 1937 and 2002 is low compared with other geographic areas.

On 3 –4 July 2004, between 150 and 200 melon-headed whales (*Peponocephala electra*) occupied the shallow waters of Hanalei Bay, Kaua'i, Hawai'i for over 28 hours. The usually pelagic animals milled in the shallow confined bay and were returned to deeper water with human assistance. The whales were observed entering the Bay in a single wave formation on July 3, 2004 and were observed moving back into shore from the mouth of the Bay shortly thereafter. The next morning, the animals were herded out of the Bay with the help of members

of the community, the Hanalei Canoe Club, local and Federal employees, and volunteers/staff with the Hawaiian Islands Stranding Response Group and were out of visual sight later that morning.

This event was spatially and temporally correlated with 2004 RIMPAC exercises. After ruling out other phenomena that might have caused this stranding, NMFS concluded that the active sonar transmissions associated with the 2004 RIMPAC exercise were a plausible contributing causal factor in what may have been a confluence of events. Other factors that may have contributed to the stranding event include the presence of nearby deep water, multiple vessels transiting in a directed manner while transmitting active sonar over a sustained period, the presence of surface sound ducting conditions, and intermittent and random human interactions while the animals were in the Bay.

Based on the 2001 stranding event in the Bahamas, NMFS believes that the presence of surface ducts, steep bathymetry, and/or constricted channels when added to the operation of mid-frequency sonar in the presence of cetaceans (especially beaked whales and other deep divers) may increase the likelihood of producing a sound field with the potential to cause cetaceans to strand, and therefore, necessitates caution. Additionally, based on the report of the Hanalei Bay stranding incident during RIMPAC 2004, NMFS concludes that it was possible that sonar transmissions caused behavioral responses in the animals that led to their swimming away from the sound source, into the sound shadow of the island of Kauai, and entering Hanalei Bay. NMFS has therefore added significant mitigative precautions to significantly minimize the potential for negative impact.

2) Harassment Thresholds and Safety Zones - For the purposes of the proposed IHA for this activity, NMFS recognizes three levels of take: Level A Harassment (Injury), Level B Harasssment (Behavioral Disruption), and mortality (or serious injury that may lead to mortality). Mortality, or serious injury leading to mortality, may not be authorized with an IHA.

NMFS has determined that for acoustic effects, acoustic thresholds are the most effective way to consistently both apply measures to avoid or minimize the impacts of an action and to quantitatively estimate the effects of an action. Thresholds are commonly used in two ways: (1) To establish a shut-down or power down zone and (2) to calculate take. The threshold level and the associated mitigation is directly related to the level of protection provided to marine mammals.

Level A Harassment (refer to IHA Federal Register Notice for explanation of terms)

Permanent Threshold Shift (PTS) consists of non-recoverable physical damage to the sound receptors in the ear and is, therefore, classified as Level A harassment under the MMPA. NMFS proposes the use of 215 dB re 1 mPa2-s as the acoustic threshold for PTS. This threshold is based on a 20 dB increase in exposure Exposure Level (EL) over that required for onset-Temporary Threshold Shift (TTS) (195 dB). Extrapolations from terrestrial mammal data indicate that PTS occurs at 40 dB or more of Threshold Shift (TS), and that TS growth occurs at a rate of approximately 1.6 dB TS per dB increase in EL. There is a 34 dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). Therefore, an animal would require

approximately 20dB of additional exposure (34 dB divided by 1.6 dB) above onset-TTS to reach PTS. The justification for establishing the 215 dB acoustic criteria for PTS is described in detail in both the Navy's RIMPAC IHA application and the Undersea Warfare Training Range USWTR DEIS.

Level B Harassment

Temporary Threshold Shift (TTS) - The proposed TTS threshold is primarily based on cetacean TTS data from Schlundt et al. (2000). These tests used short-duration tones similar to sonar pings, and they are the most directly relevant data for the establishing TTS criteria. The mean exposure EL required to produce onset-TTS in these tests was 195 dB re 1 mPa2-s. This result is corroborated by the short-duration tone data of Finneran et al. (2000, 2003) and the long-duration noise data from Nachtigall et al. (2003a,b). Together, these data demonstrate that TTS in cetaceans is correlated with the received EL and that onset-TTS exposures are fit well by an equal-energy line passing through 195 dB re 1 mPa2-s. The justification for establishing the 195 dB acoustic criteria for TTS is described in detail in both the Navy's RIMPAC IHA application and the USWTR DEIS.

"Sub –TTS" - NMFS believes that behavioral disruption of marine mammals may result from received levels of mid-frequency sonar lower than those believed necessary to induce TTS. As of yet, no controlled exposure experiments have been conducted wherein wild cetaceans are deliberately exposed to tactical mid-frequency sonar and their reactions carefully observed. In the absence of controlled exposure experiments, the following investigations and reports constitute the best available scientific information for establishing an appropriate acoustic threshold for sub-TTS behavioral disruption: (1) Finneran and Schlundt (2004); (2) Nowachek et al. (2004); and (3) NMFS (2005). Based on these three studies, NMFS has set the sub-TTS behavioral disruption threshold at 173 dB re 1 mPa2-s (SEL).

Mitigation Measures (See Appendix B and IHA)

Determination

Considering the factors listed above and the mitigation requirements in the IHA and considering the comments received on the proposed IHA and the EA, NOAA has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, the preparation of an Environmental Impact Statement is not required.

William T. Hogarth — 27 June 2006

William T. Hogarth, Ph.D.
Assistant Administrator for Fisheries, NOAA

APPENDIX A - Compliance with 40 CFR 1502.22 for RIMPAC IHA Impact Analysis

Information that is Unavailable or Incomplete.

The overarching issue of the effects of anthropogenic sound on marine mammals is broadly recognized as containing a good deal of scientific uncertainty as a result of incomplete or unavailable information. We have limited information on the basic hearing capabilities of marine mammals; how marine mammals use natural sound to communicate; the importance of sound to the normal behavioral and social ecology of marine mammals; the mechanisms by which human-generated sounds affect the behavior and physiology (including the non-auditory physiology) of marine mammals, and the circumstances that are likely to produce outcomes that harm marine mammals. The information to resolve these questions cannot be readily obtained and it will be years if not decades before enough studies have been undertaken to alleviate some of the uncertainty. **The attached table (Appendix B) highlights each mitigation measure and the uncertainty it will address.**

With respect to this proposed action, NMFS has focused on three main areas of uncertainty and incomplete or unavailable information in developing mitigation, monitoring, and shutdown requirements.

1) We have limited information on the fine-scale distribution of marine mammal stocks in the Hawaiian operating area and therefore on the number of marine mammals potentially affected by the activity. While estimates of abundance will improve with future population surveys, these are migratory and transitory animals that move over broad areas in short periods of time, therefore estimates of encounter rates will always be based on assumptions regarding densities and distribution.

2) There is uncertainty about the received sound levels that will result in behavioral disturbance for species or individual marine mammals or for non-marine mammal species. We will likely never be completely certain about the received sound levels that result in behavioral disturbance given that there are individual differences in the sensitivity to sound. This information is important in estimating threshold levels upon which to base mitigation measures (in particular safety or exclusion zones) to protect marine mammals from received levels that will cause behavioral disturbance.

3) Finally, there is uncertainty about the mechanisms associated with marine mammal strandings in association with mid-range sonar. Over the past 10 years, there have been four stranding events coincident with military mid-frequency sonar use that are believed to most likely have been caused by exposure to the sonar. These occurred in Greece (1996), the Bahamas (2000), Madeira (2000), and Canary Islands (2002). Cuvier's beaked whales have been the most common species involved in stranding events associated with sonar. It is not clear whether (a) beaked whales are more prone to injury from high-intensity sound than other species, (b) its behavioral response to sound makes it more likely to strand, or (c) it is substantially more abundant than the other affected species at the times and places of exposure. Competing theories about the link between sonar and strandings include a physical reaction between sound and gases in supersaturated tissues leading to a condition like the bends or that some marine mammals,

such as beaked whales and other deep-diving marine mammals, may react to mid-frequency sonar, at received levels lower than those thought to cause direct physical harm, with behaviors that may, in some circumstances, lead to physiological harm, stranding, or potentially, death. Our understanding of the potential mechanisms or characteristics of these circumstances is incomplete.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impact of RIMPAC Mid-frequency tactical sonar and Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

The primary sources of information on the effects of sound on marine mammals were reviews conducted by the National Research Council (NRC 1994 1996, 2000, 2005), Richardson *et al.* (1995) on marine mammals and noise, the Navy's Low Frequency Sound Scientific Research Program, Marine Mammal Research Program (which was developed to address questions associated with the Advanced Research Projects Agency's Acoustic Thermometry of Ocean Climate project, and numerous scientific papers (Croll *et al.* 1999 and 2001; Frankel and Clark 1998; Richardson *et al.* 1995; Tyack 2000; Whitlow *et al.* 1997).

) Marine mammals potentially affected by the activity.

The Navy has used data compiled from available sighting records, literature, satellite tracking, and stranding and bycatch data to identify the species of marine mammals present in the OpArea. A combination of inshore survey data (within 25 nm) and offshore data (from 25 nm offshore out to the U.S. EEZ) was used to estimate the density and abundance of marine mammals within the OpArea. Additional information regarding the status and distribution of the 27 marine mammal species that occur in the OpArea may be found in the Navy's application, the associated EA, and in NMFS' Stock Assessment Reports. An analysis was conducted for RIMPAC 2006, modeling the potential interaction of mid-frequency active sonar with marine mammals in the OpArea. The model incorporates site-specific sound speed information, the sound source's frequency and vertical beam pattern, and multipath pressure information as a function of range, depth and bearing. NMFS believes that the model take estimates are overestimates because the mitigation measures have not been taken into account in the model; the model does not account for movement of marine mammals; and the model assumes each exposure involves a different animals, an unrealistic assumption that inflates the number of exposures.

2) Threshold Levels

Both the PTS and TTS threshold levels are based on data from a number of scientific studies, including Finneran (2000, 2003) and Nachtigall et al. (2003a,b). The justification for establishing these thresholds are described in detail in both the Navy's RIMPAC IHA application and the Undersea Warfare Training Range USWTR DEIS.

The area of behavioral disruption without TTS, (what NMFS terms as "sub-TTS" behavioral disruption), is the area of greatest uncertainty. As of yet, no controlled exposure experiments

have been conducted to observe reactions of wild cetaceans to tactical mid-frequency sonar. In the absence of controlled exposure experimental data, the following investigations and reports (described in detail in the IHA Federal Register notice) constitute the best available information for establishing an appropriate acoustic threshold for sub-TTS behavioral disruption.

With respect to RIMPAC, the agency analyzed all the scientific information available that could shed light on this subject and narrowed the scope to 3 key studies to inform us. Finneran and Schlundt (2004) analyzed behavioral observations from TTS studies of captive bottlenose dolphins and beluga whales, Nowachek et al. (2004) conducted controlled exposure experiments on North Atlantic right whales using ship noise, social sounds of con-specifics, and an alerting stimuls, and NMFS (2005) analyzed behavioral reactions of killer whales in the presence of tactical mid-frequency sonar. Based on our evaluation of these three studies and the compendium of scientific information on this matter, we have established 173dB SEL as the appropriate criterion.

3) Strandings – As noted in the FONSI, there are four stranding events coincident with military mid-frequency sonar use that are believed to most likely have been caused by exposure to the sonar. These beaked whale strandings have prompted inquiry into the relationship between mid-frequency active sonar and the cause of those strandings. The specific mechanisms that led to these strandings is uncertain.

It is uncertain whether beaked whales were directly injured by sound (a physiological effect) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to strand and be injured. Several potential physiological outcomes caused by behavioral responses to high-intensity sounds have been suggested by Cox et al. (in press). These include gas bubble formation caused by excessively fast surfacing; remaining at the surface too long when tissues are supersaturated with nitrogen; or diving prematurely when extended time at the surface is necessary to eliminate excess nitrogen.

One theoretical cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996). This is the process of increasing the size of a bubble by exposing it to a sound field. The effect of rectified diffusion would mirror the effects of decompression sickness in humans. It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. Yet another hypothesis has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson et al., 2003). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Collectively, these hypotheses can be referred to as "hypotheses of acoustically mediated bubble growth."

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood. Further, although it has

been argued that traumas from some recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson et al., 2003), there is no conclusive evidence of this.

During the RIMPAC exercise there will be use of multiple sonar units in an area where three beaked whale species may be present. A surface duct may be present in a limited area for a limited period of time. Although most of the ASW training events will take place in the deep ocean, some will occur in areas of high bathymetric relief. However, none of the training events will take place in a location having a constricted channel with limited egress similar to the Bahamas. Consequently, not all five of the environmental factors believed to contribute to the Bahamas stranding (mid-frequency sonar, beaked whale presence, surface ducts, steep bathymetry, and constricted channels with limited egress) will be present during the RIMPAC ASW exercise. However, NMFS believes caution should be used anytime either steep bathymetry, surface ducting conditions, or a constricted channel is present in addition to the operation of mid-frequency tactical sonar and the presence of cetaceans (especially beaked whales). Therefore, NMFS is requiring additional mitigation and monitoring for choke point exercises to provide greater protection for beaked whales and other marine mammals during these activities.

3) Impacts to fish - There have been few directed studies on the impact of sonar on fish. What we do understand from the scientific literature is that most marine species of bony fish are hearing generalists, with their best hearing range below 300 Hz frequency (Popper 2003). Behavioral studies have shown that the upper limit of most bony fish that are hearing specialist is within the 1-3 kHz (1,000 to 3,000 Hz) frequency range (Popper, 2000), with most hearing specialist responding best at around 2 kHz (Popper, 2003). It has been demonstrated that a few species (i.e., bay anchovy – *Anchoa mitchilli*; scaled sardine – *Harengula jaguana*; and Spanish sardine – *Sardinella aurita*) can detect sounds to about 4 kHz (4,000 Hz) and that one species (American shad – *Alosa sapidissima*) is able to detect sounds up to 180 kHz (180,000 Hz) (Mann, et al., 2001). Cartilaginous fishes, such as sharks and rays, probably hear the best in the 40 Hz to 125 Hz frequency range, with hearing frequency ranges possibly up to about 325 Hz (Corwin 1981). Mid-frequency sonars range from 1 kHz (1,000 Hz) to 10 kHz (10,000 Hz), but most of the louder, hull-mounted sonars actually operate in the 3 kHz to7 kHz frequency range. Thus, it is expected that hearing specialist may be able to detect the lowest frequencies of mid-frequency sonar (around 1 - 3 kHz).

In a study of the response of fishes to mid-frequency sonars (1.6 and 4 kHz), Jorgensen et al. (2005) observed the behavior of four unrelated marine species (saithe, *Pollachius virens*, wolf fish *Anarhichas minor*, cod *Gadus morhua*, herring *Clupea harengus)*. Juvenile herring responded with startle behaviors sonar signals around 170 dB re 1 µPa, but resumed normal activity after the first few pulses. However, in tests with received levels around 180 - 189 dB re 1 µPa, juvenile herring exhibited startle behaviors followed by abnormal swimming. In addition, strong distress was evident during presentation of a series of 100 frequency modulated sonar pulses at around 180 dB re 1 µPa. The other species of juvenile fishes did not exhibit startle responses or any other behavioral evidence that the mid-frequency sonar pulses were detected at any level, as expected for fishes with no known auditory specializations for reception of frequencies above 1 kHz. Jorgensen et al. (2005) and Kvadsheim and Sevaldsen (2005) found

that juvenile herring may sustain mortal injuries from intense mid-frequency sonar pulses (1 – 3 kHz) and hull-mounted and towed arrays with frequencies up to 8 kHz, respectively.

Wysocki and Ladich (2005) investigated the influence of noise exposure on the auditory sensitivity of two hearing specialists (goldfish - *Carassius auratus* and lined Raphael catfish – *Platydoras costatus*) and a hearing generalist (sunfish – *Lepomis gibbosus*). Baseline thresholds showed greatest hearing sensitivity around 0.5 kHz (500 Hz) in the goldfish and catfish and at 0.1 kHz (100 Hz) in the sunfish, the hearing specialists. For the hearing specialists (goldfish and catfish), continuous white noise of 130 dB resulted in a significant threshold shift of 23-44 dB. In contrast, the auditory thresholds in the hearing generalist (sunfish) declined by 7-11 db. It was concluded that acoustic communication and orientation of fishes, in particular of hearing specialists, may be limited by noise regimes in their environment.

Studies have also found that hearing generalists normally experience only minor or no hearing loss when exposed to continuous noise, but that hearing specialists may be affected by noise exposure, for example acoustic communication might be restricted in noisy habitats (Amoser and Ladich, 2003; Smith, et al., 2004 a and b).

With respect to mid-frequency sound, research has been conducted on acoustic devices designed to deter marine mammals from gillnet fisheries (Gearin et al., 2000; Culik et al., 2001) to ascertain how noise may affect fish behavior. These devices generally have a mid-frequency range, similar to mid-frequency sonar devices. Adult sockeye salmon exhibited an initial startle response to the placement of inactive acoustic alarms designed to deter harbor porpoise (Gearin et al., 2000). The fish resumed their normal swimming pattern within 10 to 15 seconds. After 30 seconds, the fish approached the inactive alarm to within 30 cm (1 ft).

The same experiment was conducted with the alarm active. The fish exhibited the same initial startle response from the insertion of the alarm into the tank; however, within 30 seconds, the fish were swimming within 30 cm (1 ft) of the active alarm. After five minutes of observation, the fish did not exhibit any reaction or behavior change except for the initial startle response (Gearin et al., 2000). This demonstrated that the alarms were either inaudible to the fish, or the fish were not disturbed by the mid-frequency sound (Gearin et al., 2000).

The results of several studies have indicated that acoustic communication and orientation of fishes, in particular of hearing specialists, may be limited by noise regimes in their environment (Wysocki and Ladich, 2005). However, it is expected that most marine fish species are hearing generalists and would not be able to detect mid-frequency sonar.

Given that the proposed operations would use mid-frequency sound sources, which range from 1 kHz (1,000 Hz) to 10 kHz (10,000 Hz), with most of the louder hull mounted sonars in the 3 kHz -7 kHz frequency range NMFS expects that the majority of marine species would not be able to detect mid-frequency sonar. On the other hand, juvenile fish that are close enough to the sonar source may experience injury or mortality, but effects are likely to be minor considering the limited exposure of the fish to the sound source.

Based on the scientific literature, NMFS believes that RIMPAC sonar operations would have a minimal effect on any stocks of fish in the Hawaii area. There is not enough information to have scientifically supportable guidance on appropriate mitigation for fish. However, given the mitigation measures in place for protecting marine mammals, and the scientific literature on the effects of anthropogenic sound on fish, NMFS anticipates that these measures could also have a positive effect on protecting fish.

4) Cumulative Impacts - Richardson *et al.* (1995) provided extensive information and arguments about the potential cumulative effects of man-made noise on marine mammals. Those effects included masking, physiological effects and stress, habituation, and sensitization. Although all of these responses have been measured in terrestrial animals reacting to airborne, man-made noises, those studies are counterbalanced by studies of other terrestrial mammals that did not exhibit these responses to similar acoustic stimuli.

Richardson *et al.* (1995) recommended several operational measures to minimize the effects of man-made sounds on marine mammals. These included minimizing source levels, minimizing duty cycles, and gradually increasing projected sound levels (i.e., ramp-up) to allow animals to move away from the source before source levels peak. The IHA requires the implementation of mitigation measures for RIMPAC to minimize the potential cumulative impacts of mid-frequency sonar on marine mammals.

Mitigation

The presence of uncertainty and unknown risk described above has led NMFS to develop mitigation measures to ensure, to the greatest extent foreseeable, that significant impacts can be avoided.
These mitigation measures are expected to avoid the potential for serious injury, mortality or catastrophic consequences. In the event that these mitigation measures are not adequate and a stranding or injury does occur, NMFS has developed a specific process to shut down the activity. These measures are outlined in the attached Appendix B.

Qualitative Assessment of Negligible Impact and Required Mitigation Measures to Minimize Serious Injury, Mortality and Other Significant Impacts

Measures that make the chances of a stranding less likely	**Mechanisms**
1) No sonar operation in areas of steep bathymetry or constricted channels (except for 3 chokepoint exercises)	Measures 1, 2, and 3 all reduce the chances of a confluence of 3 or more of the five factors believed to have contributed to the Bahamas stranding
2) Expanded power-/shut-down zone in strong surface-ducting conditions (2 km power-down, 500m shutdown)	Measure 3 also gives beaked whales (or other deep divers) that may potentially have been driven by sonar into a constricted channel or shallow disorienting circumstances, a wider berth around the sound source to escape to deeper water
3) No sonar operation within 25 km of 200 m isobath (except for three chokepoint exercises and events occurring on range areas managed by PMRF)	Measure 4 (because of wider view and ability to cover larger area) specifically decreases the chances that animals will enter the safety zone without being seen and increases the chances that injured animals or animals exibiting abnormal behaviors (indicative of a potential stranding) are sighted, and sonar shut down
4) During chokepoint exercises, real-time aerial monitoring linked to sonar operation (to advise shut-down, etc.)	*All Measures in this section also reduce # of animals exposed and exposure levels
Measures that further contribute to a negligible impact	
5) Standard (not during strong surface ducts) expanded, power-down zones	In Measure 5 (versus the power-/shutdown at injury threshold required in previous authorizations), power-down will occur if an animal gets within 1000 m (which NMFS believes will typically be at a distance ensonified to a lower level than that thought to induce injury) and again at 500 m, which will both reduce the numbers of animals exposed and the levels to which they are exposed.
6) NMFS-trained lookouts will visually monitor around all ships operating mid-frequency sonar	
7) Though most are not dedicated observers, all RIMPAC participants (many with good opportunity) are required to report marine mammal sightings to the Officer in Command (lookouts, pilots, passive acoustic monitors)	In Measures 4, 6, and 7, real-time monitoring, in combination with power- and shut-down zones, decreases both the number of animals potentially exposed to sound, and the sound level to which they are exposed

Further considerations in the negligble impact determination for this specific activity

A) Because this IHA does not authorize injury or mortality, the chance of adversely affecting the affected species through annual survival rates is low.

B) The number of individuals harassed, in relation to the abundance of the species or stock, factors into the negligible impact determination. The numbers produced by the model do not take into account that the above measures reduce the the number, as well as the severity, of exposures significantly.

C) NMFS believes the Navy's model overestimated the number marine mammals taken by assuming that animals remain stationary throughout their overlap with the ensonified area, that an animal is always located in the loudest point in any column of ensonified water, and that every exposure is a different animal .

D) Additionally, the majority of the populations of the marine mammals around Hawaii extend out beyond the EEZ, and so the percentages of the animals in the EEZ affected are higher than the percentage of the biological populations.